17th World Congress on Computational Mechanics
10th European Congress on Computational Methods in Applied Sciences and Engineering
WCCM-ECCOMAS2026
July 19-24, 2026, Munich, Germany

DATA-DRIVEN COMPUTATIONAL MECHANICS AND AI FOR ADVANCED MATERIALS AND MULTIPHYSICS SYSTEMS

TRACK NUMBER (600)

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Keywords: Nano Materials, High-Performance Computing, Fluid Dynamics, Thermal Reservoir Computing.

ABSTRACT

Recent advances in machine learning (ML), artificial intelligence (AI), and data science are revolutionizing computational mechanics and materials modeling. This mini-symposium aims to provide a platform for researchers working at the intersection of AI and computational science, targeting applications in nano- and quantum materials, fluid dynamics, and complex thermophysical systems. Emphasis is placed on first-principles modeling augmented by data-driven approaches, as well as on emerging paradigms such as thermal reservoir computing, AI-accelerated multiscale modeling, and high-performance computing (HPC) for simulation-based design. Contributions involving novel algorithms, hybrid physics-AI models, and application-driven case studies are strongly encouraged.

Topics of Interest Include (but are not limited to):

- Machine learning for computational fluid dynamics (CFD)
- Thermal reservoir computing and physical neural networks
- AI-accelerated simulation of nano- and quantum materials
- High-throughput first-principles and data-driven screening
- Hybrid ML/physics-based models for multiphysics coupling
- High-performance computing with AI for large-scale simulations
- Graph neural networks and physics-informed neural networks (PINNs)
- Generative models for material structure-property design